CSE 118 - Tue 10/16

Nadir Weibel
Today

• Grades and Submissions
  • Annotations / Reading Summary
• Survey on prototyping
• PrototipAR Logistics
• Mini Quiz on Week 2
• Augmented Virtual and Mixed Reality
  • Demos of AR/VR Devices
Grades and Submissions

- Annotations and Reading Summary will now be submitted as separate assignments.
- Please resubmit your annotations on the new assignment for Week 2 now.
- Discussion is not to be turned in, it is only for us to grade your participation and for you to see the grades.
- Project Assignments need to be turned in by the grad students in your team, so do not turn it in. You will see your grades there.
How do you Prototype?

Please complete this short survey now (link on Piazza as well)

https://goo.gl/forms/LDzt3sLVLDuUXpU33
PrototipAR
Assignments

Logistics
PrototipAR

- PrototipAR is an Augmented Reality (AR) prototyping tool that enables designers to create AR experiences embedded in the world. Users can sketch interfaces and objects, add behaviors and interactions, and experience everything live without writing a single line of code.

What You Sketch Is What You Get:
Quick and Easy
Augmented Reality Prototyping
with PintAR
How to reserve a HoloLens + iPad

• Follow this link
  
  • http://bit.ly/hololens118218

• Open the calendar and reserve at least one slot per week
  
  • Teams should not reserve more than one slot per day

• Devices will be available in the Virtual Reality lab at the basement, B210 (Code in tritonlink, please check)
How to submit this week's assignment

- Two videos per prototype
  - Hololens perspective (recorded through HoloLens)
  - multiple third-person videos
- Description of prototype (max ½ page)
- Google Doc with any comments / videos / pictures of your experience using the tool (PrototipAR)
- Tutors / TAs will help you get started with the tool this week
Mini Quiz on Week 2
Google Classroom
Augmented and Mixed Reality

Credits: D. Johnson, A Wong, G. Schwartz
What Is Augmented Reality (AR)?

- A combination of
  - a real scene viewed by a user and
  - a virtual scene generated by a computer that augments the scene with additional information.
Is this Augmented Reality?
Is this Augmented Reality?
Is this Augmented Reality?
Is this Augmented Reality?
Is this Augmented Reality?

“The yellow line in football showing the location of the first down line”
Is this Augmented Reality?
Is this Augmented Reality?
Is this Augmented Reality?

GPS directions via only voice
Is this Augmented Reality?
Our Definition

Augmenting the real-world with data
Augmented Reality vs. Virtual Reality

**Augmented Reality**

- System augments the real world scene
- User maintains a sense of presence in real world
- Needs a mechanism to combine virtual and real worlds
- Hard to register real and virtual

**Virtual Reality**

- Totally immersive environment
- Senses are under control of system
- Need a mechanism to feed virtual world to user
- Hard to make VR world so interesting as in AR
Combining the Real and Virtual Worlds

We need:

- Precise models
- Locations and optical properties of the viewer (or camera) and the display
- Calibration of all devices
- To combine all local coordinate systems centered on the devices and the objects in the scene in a global coordinate system
Display Technologies

• Monitor Based
  – Laptops
  – Cell phones
  – Projectors (more Ubiquitous Computing)

• Head Mounted Displays:
  – Video see-through
  – Optical see-through
Monitor Based Augmented Reality

- Simplest available
- Treat laptop/PDA/cell phone as a window through which you can see AR world.
Monitor Based AR

- Successful commercialization
  - Yellow line in football broadcasts
  - Glowing hockey puck
  - Replace times square billboards with own commercials during New Year’s Eve broadcasts
  - Ad campaigns
Optical see-through HMD
Video see-through HMD

Diagram:
- Video of real world
- Scene generator
- Graphic images
- Video compositor
- Head tracker
- Video cameras
- Monitors
- Real World

Combined video
Advantages of Video see-through HMD

- Flexibility in composition strategies
- Real and virtual view delays can be matched
Advantages of Optical see-through HMD

- Simplicity
- Resolution
- No eye offset
Monitor Displays

- Consumer-level equipment
- Most practical
- A lot of current research aimed here
- Other current active area is a flip-down optical display.
Early Application

- KARMA (91)
  - Feiner
- Optical see-through HMD
- Knowledge-based assistant for maintenance
- Ultrasound trackers attached to assembly parts
Early Application
Current Applications
Vuforia

Qualcomm® Vuforia™ Developer Portal

Breakthrough Gaming Experiences
Smart Terrain™ enables users to create their own play spaces and provides apps the intelligence to interact with objects and surfaces.

LEARN MORE

Resources
Documentation and sample code to integrate Vuforia into your app.
- Getting Started
- Developer Guide
- Sample Code
- Forums

API Reference
Get detailed API information for supported platforms.
- Java (Android)
- C++ (Android/iOS)
- Unity (Android/iOS)

Vuforia 3.0
DOWNLOAD

https://developer.vuforia.com/
https://www.qualcomm.com/products/vuforia
Google Glass

- Google Glass is a wearable computer with an optical head-mounted display (OHMD) that is being developed by Google in the Project Glass research.
How it works
Bone conduction transducer: Sends audio directly to inner ear through bones of skull, eliminating need for headphone

Microphone
Give audio commands or make phone calls*

Prism

Computer
GPS and Wi-fi 12GB storage

Camera
Photos – 5MP Video – 720p HD

Battery
Power for “one full day of typical use”

HOW IT WORKS
Normal vision

Projector

Prism
Reflects display on retina

Retina

VIEWING EXPERIENCE

Reality
Wearer’s normal vision

Overlay
Information appears as translucent image
How it works

Martin Missfeldt
HoloLens
# HoloLens Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Windows 10.0.11802.1033 32-bit</td>
</tr>
<tr>
<td>CPU</td>
<td>Intel Atom x5-Z8100 1.04 GHz</td>
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<tr>
<td></td>
<td>Intel Airmont (14nm) 4 Logical Processors 64-bit capable</td>
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<tr>
<td>GPU/HPU</td>
<td>HoloLens Graphics</td>
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<tr>
<td>GPU Vendor ID</td>
<td>8086h (Intel)</td>
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<tr>
<td>Dedicated Video Memory</td>
<td>114 MB</td>
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<tr>
<td>Shared System Memory</td>
<td>980 MB</td>
</tr>
<tr>
<td>RAM</td>
<td>2GB</td>
</tr>
<tr>
<td>Storage</td>
<td>64GB (54.09 GB available)</td>
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<tr>
<td>App Memory Usage Limit</td>
<td>900 MB</td>
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<tr>
<td>Battery</td>
<td>16,500 mWh</td>
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<tr>
<td>Camera Photos</td>
<td>2.4 MP (2048x1152)</td>
</tr>
<tr>
<td>Camera Video</td>
<td>1.1 MP (1408x792)</td>
</tr>
<tr>
<td>Video Speed</td>
<td>30 FPS</td>
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HoloLens Sensors

- 18 sensors
  - Including accelerometer, gyroscope, magnetometer, microphone
  - Depth cameras that are based on Kinect technology, but with a wider field of sensing (120x120 degrees)
- Two visual cameras and two depth cameras
- Visual cameras can record and share the user's visual experience from a first person perspective
  - Sensor to measures the interpupillary distance
Holographic Display

- Light engine - sends out light beams towards two separate transparent lenses (one for each eye)

- Lens consist of three layers of glass of three different primary colors

- Each lens has "micro-thin" corrugated grooves

- Light hits those layers and finally enters the eye in specific angles, intensities and colors

- Producing an image on the eye's retina.

- Significantly different from most 3D systems such as the Oculus Rift – It doesn’t use lenses to refract light from a screen onto the eye.

- Image is clear, but not "4k-like"

- Buttons to control video brightness on the top of the device
Hololens — light engines

- 2 HD 16:9 “light engines”
- 2.8 million light points
TRACKING USER'S POSITION

- Cameras detect movement relative to static objects surrounding the user
- Accelerometer, gyroscope and magnetometer provide additional data to improve tracking
- Very low latency depth cameras which are intelligent enough to translate the depth information into a complete spatial map
Interacting with HoloLens

• Speakers on top of both ears and a 3.5mm headphone jack

• Buttons to control audio on the top of the device

• The device has “spatial sound” Gaze which is effectively similar to moving a mouse by moving your head

• Depth and Visual cameras recognize gestures such as “air-tap” and “bloom”

• Voice commands such as ”hey, Cortana” to bring up Cortana

• Buttons to control volume and brightness

• - Additional air clicker to use instead of the gaze and air-tap

• - Device portal to manage the HoloLens wirelessly
Interacting with HoloLens

- Virtual objects onto real objects (on tables, walls, …)
- Changing the texture, appearance and lighting of real objects
- Virtual holes into real objects or making real objects disappear
- Virtual screens into the real world
- Moving a cursor or virtual objects by head movement
- Initiating actions by doing hand gestures or voice commands
- Replacing the complete environment with a virtual one
- Integrating real objects into a virtual environment
- Moving a cursor from a real screen into the virtual world using a mouse
- …?
Next Steps

- Readings to discuss on Thursday
- AR Paper
- Design Paper
Next Steps

• Read/Annotate all papers

• Submission of Annotations and Reading Summary On Google Classroom

• PrototipAR project submission on Sunday 11.59pm

• Next Week: Physiological Sensors and Eye-Tracking
Thanks
AR / MR Hands on